Prediction of the permeability of damaged concrete using a combined lattice beam-crack network approach

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ABSTRACT: The article describes a combined damage and permeability 3D model for concrete. The objective of the model is to predict the permeability of damaged concrete. For the mechanical model a lattice of beam elements is used where the damage is modelled by a step-by-step removal of beams. For the calculation of the permeability the removed beams are connected by transport elements with a aperture proportional to the relative displacement between the nodes previously connected by the beans. The numerical simulations are then compared with experimental results from a diffuse tensile cracking and permeability test. Two lattice models are compared with the experimental results: in the first one the concrete is considered as a homogenous material and in the second the aggregates are explicitly modelled. It is shown that when the aggregates are
included, the simulation agrees better with the test results for lower strains, while for higher strains the homogeneous model agrees better.

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